but that they would be allowable if written in independent form including all of the limitations of the base claim and any intervening claims. Given this indication of allowability, Applicants will not further address or comment upon claims 12-24 herein. At this time, however, Applicants elect not to rewrite these claims in independent form because, *inter alias*, Applicants believe that the independent claims and intervening claims from which claims 12-24 depend also are allowable. Support for this belief is set forth herein.

Objection to the Drawings

In response to the objection to the drawings set forth in the Office Action at page 2, Applicants have filed concurrently with this Office Action No. 1 a new set of formal drawings. Applicants submit that these drawings fully address and satisfy the examiner's requirement for new formal drawings. Entry of the formal drawings and withdrawal of the objection to the drawings accordingly are requested.

Rejection of Claims 1-4, 36 and 39-43
Under Section 102(b) (Maw et al.)

To anticipate a claim under Section 102(b), a reference must fully disclose the invention as claimed, and thus each limitation of the claimed invention must be identically disclosed in the reference. *Helifix Ltd. v. Blok-Lok Ltd.*, 208 F.3d 1339, 54 U.S.P.Q.2d (BNA) 1299 (Fed. Cir. 2000).

Claim 1 is not anticipated by and patentably distinguishes over Maw et al., U.S. Patent No. 5,783,751 (hereinafter "Maw") in that Maw fails to disclose an instrumented pin member comprising a pin member body disposed about a pin

member axis, the pin member body comprising a bending portion, a sensing device positioned at the pin member body within the bending portion for sensing a bending strain in the bending portion exclusive of a net axial strain, and for outputting a sensor measurement signal representative of the bending strain, and a sensor measurement signal output device for outputting the sensor measurement signal from the sensor device, as disclosed in claim 1.

Maw et al. is directed to a force sensor primarily for use in numerically controlled machine tools. It discloses placing a pair of opposed strain gauges 20a and 20b (see Figs. 1 and 2) on opposite sides of a body 10, disposed at the distal end of the body. The body 10 may be substituted, for example, as a turret screw in the cutting tool assembly. As the cutting tool becomes dull and forces are applied to the body 10, they are sensed by the sensors 20a and 20b, and the resulting signal is used, via a Wheatstone bridge, to actuate an alarm.

Maw expressly is directed to the measurement of variations in cutting force, and does not describe a sensing device for sensing a bending strain in a bending portion exclusive of a net axial strain. Indeed, Maw appears to teach away from the invention of claim 1 by including slot type opening 13, which purportedly increases sensitivity and therefore would reduce or minimize measurements in dimensions other than the force measurement for which it is intended.

The portions of Maw cited in Office Action No. 1 supporting this rejection, i.e., column 3, starting at line 11, and column 2, lines 41-46 and 53-56, merely disclose this cutting force variation measurement. It refers at column 3, lines 11 et seq. as

detecting strain variations, but fails to expressly indicate what strain variations are being measured. Given the stated objective of measuring cutting force variations, one of ordinary skill in the art may take this document as teaching simultaneous longitudinal or stretching forces on the strut, but not bending strain. This also is supported by the absence of any mention of bending strain measurement in Maw. Nor is there any indication in Maw that bending strain is being sensed exclusive of net axial strain. To the contrary, Maw appears to be measuring axial strain.

Claim 1 is not rendered obvious over Maw, for example, because Maw is directed to measurement of cutting force variations, not bending strain in a bending portion exclusive of a net axial strain, and because Maw fails to disclose any motivation or suggestion to modify its limited teachings to add this bending strain measurement feature as recited in claim. As indicated above, Maw teaches away from such modification, for example, by its inclusion of slot 13 to limit its measurement capability in dimensions other than the one disclosed.

Dependent claim 2 is not anticipated by Maw, for example, in that Maw fails to disclose a sensing device that senses components of the bending strain in the bending portion along an x axis and a y axis, wherein the x axis and the y axis are orthogonal to the pin member axis and to each other, as recited in claim 2. Maw discloses only one pair of parallel sensors 20a and 20b, and therefore is incapable of sensing strain in x and y dimensions.

The Office Action at page 3, second bullet, indicates that the Maw device inherently senses the components of the bending strain in the bending portion of

the pin along the x axis and a y axis. It appears, however, that this improperly characterizes Applicants' z axis (along the longitudinal axis of the pin) as the y axis, and therefore is not in keeping with the express language of the claim. Maw's sensors 20a and 20b are positioned opposite one another along a plane passing through body 10 and through those sensors. The Maw device therefore is incapable of measuring bending strain in two orthogonal planes.

The Office Action at page 5, incidentally, expressly states that Maw fails to disclose "the sensor elements being positioned to measure the bending strain in the x-axis and the y-axis, as in claim 6-7 and 9. This same, correct conclusion applies with respect to claim 2.

Maw also fails to render the invention of claim 2 obvious, for example, for the reasons set forth above as to claim 1, and further in that it includes no motivation or suggestion to modify its relatively simple construction and disclosed operation to include bending strain measurement, particularly along orthogonal x and y axes, as recited in claim 2.

Claims 3 and 4 are not anticipated by Maw, for example, for the reasons set forth herein with respect to claim 1.

Maw also fails to anticipate claim 36, for example, in that Maw fails to disclose a system for measuring bending at a joint, wherein the system comprises an instrumented pin member disposed at the joint, the instrumented pin member comprising a pin member body disposed about a pin member axis, the pin member body comprising a bending portion, a sensing device positioned at the pin member

body within the bending portion for sensing a bending strain in the bending portion exclusive of a net axial strain, and for outputting a sensor measurement signal representative of the bending strain, and a sensor measurement signal output device for outputting the sensor measurement signal from the sensor device, and a data receiving device operatively coupled to the sensor measurement signal output device for receiving the sensor output signal, as recited in claim 36.

As with claim 1 and as set forth herein above, Maw is directed to the measurement of variations in cutting force, and does not describe a sensing device for sensing a bending strain in a bending portion exclusive of a net axial strain. Maw also appears to teach away from the invention of claim 36 by including slot type opening 13, which according to it increases sensitivity and thus reduces or minimize measurements in dimensions other than the force measurement for which it is intended. Maw also fails to render the invention of claim 36 obvious, for example, for the reasons set forth above with respect to claim 1.

Claims 39 and 40, which depend from claim 36, are not anticipated by Maw, and patentably distinguish over it, for example, for the reasons set forth above with regard to claim 36, and based upon their dependence from claim 36.

Maw does not anticipate claim independent claim 41, for example, because Maw fails to identically disclose a method for measuring bending at a joint, wherein the method comprises disposing an instrumented pin member at the joint, wherein the instrumented pin member comprises a pin member body disposed about a pin member axis, the pin member body comprising a bending portion, sensing a bending

strain in the bending portion exclusive of a net axial strain during a bending stress measurement mode and outputting a sensor measurement signal, and communicating the sensor measurement signal to a data receiving device, as recited in claim 41.

As explained with respect to claims 1 and 36, Maw fails to disclose a sensing device for sensing a bending strain in a bending portion exclusive of a net axial strain, and teaches away from such design by including slot type opening 13. Maw also fails to render the invention of claim 41 obvious, for example, for the reasons set forth above with respect to claims 1 and 36.

Maw fails to anticipate the invention of dependent claims 42 and 43, for example, for the reasons set forth herein regarding claims 1 and 36, and based upon their dependence from claim 41. Claim 43, for example, is further distinguishable over Maw, in that Maw fails to disclose switching in and out of a bending stress measurement mode. These claims are not rendered obvious by Maw, for example, for the reasons set forth with respect to claims 1 and 36 as to non-obviousness.

Rejection of Claims 5-11 and 25 Under
<u>Section 103(a) (Maw et al.) and Malicki</u>

Claim 5 patentably distinguishes over Maw, alone or in combination with Malicki (U.S. Patent No. 4,553,124, hereinafter "Malicki"), for example, in that neither Maw nor Malicki disclose or suggest an instrumented pin member as recited in claim 1, and further comprising the limitations of claim 5, in which the pin member body comprises a head and the bending portion is adjacent to the head.

As explained above with respect to claim 1, Maw does not render it obvious, for example, because Maw fails to disclose or suggest a sensing device for sensing a bending strain in a bending portion exclusive of a net axial strain, it fails to provide the requisite suggestion or motivation to modify its teachings to obtain this aspect of the invention, and it teaches away from such design by including slot type opening 13. Malicki also fails to disclose these aspects, and therefore the combination of these documents fails to render the invention of claim 1, and thus of claim 5, obvious.

Malicki provides strain gauges 46 on two opposing web surfaces 40 fixed to a strain gauge transducer (bolt) 10. Strain gauge sensors 46 measure deformation of the web caused by force on the strain gauge transducer 10. In the embodiments of Figs. 4-8, both compression C1 and tension T1 strain gauges are used, as shown in Fig. 4.

Significantly, Malicki not only fails to disclose or suggest measuring bend, but teaches directly away from such measurement by disclosing changing the configuration of the bridge to compensate for bend. Malicki eliminates bend to obtain an isolated measurement of strain, thus not only failing to provide the necessary suggestion or motivation, but teaching away from the invention as recited in claim 1. Malicki therefore fails to render the invention of claim 1 obvious, and also fails to provide the necessary suggestion or motivation to further amend Maw to position a bending portion adjacent to the head of a pin member, as recited in claim 5.

Claims 6-11 patentably distinguish over Maw and Malicki, taken alone or in combination, in that they depend from and more specifically recite aspects of the invention of claim 1, and because neither Maw nor Malicki disclose or suggest a sensing device comprising first and second x-axis sensor elements for measuring the bending strain along the x axis, and first and second y-axis sensor elements for measuring the bending strain along the y axis, as recited in claim 6.

It was noted above that Maw discloses only single pair of sensors 20a and 20b, and cannot measure strain in orthogonal planes. Malicki also discloses only a design in which strain gauges are disposed on opposite sides of the pin 10, and the Malicki device is not capable of measuring strain in orthogonal planes. As noted above, Malicki expressly teaches compensating for, and thus canceling out, bend measurement. These documents therefore fail to provide the necessary teaching and suggestion or motivation to yield the invention of claim 6. Claims 7-11 depend from and more specifically recite the invention of claim 6, and therefore distinguish over Maw and Malicki, taken alone or in combination, for at least this reason.

Claim 25 depends from and more specifically recites the invention of claim 1. It too patentably distinguishes over Maw and Malicki, taken alone or in combination, based on this dependence and for the reasons set forth above with respect to claim 1.

Rejection of Claims 26-35 and 37-38 Under
<u>Section 103(a) (Maw and Dillon et al.)</u>

Claims 26-34 patentably distinguish over Maw and Dillon et al. (U.S. Patent No. 5,076,375, hereinafter "Dillon"), e.g., in that neither of these documents, taken alone or in combination with the other, discloses or suggests an instrumented pin member as recited in claim 1, and further comprising a switching device operatively coupled to the sensing device for switching between an axial stress measurement configuration and a bending stress measurement configuration, as recited in claim 26.

The deficiencies of Maw with respect to claim 1 have been noted herein. Dillon is cited in the Office Action as providing the teaching of a switching device as recited in claim 26. Dillon clearly fails to remedy the deficiencies of claim 1 with respect to Maw as noted above. Claim 1 accordingly patentably distinguishes over these documents, taken alone or in combination. Claims 26-35 patentably distinguish over these documents, again, taken alone or in combination, at least based on their dependence from and more specific recitation with respect to claim 1.

Dillon et al. is directed generally to load cells with strain gauges, and more specifically to a device design in which electronic compensation is made to address the inherent non-linearity of the load cells. With reference to Fig. 3 and 4, each load cell 20 includes a set of four strain gauges 75 and 76 (compression) and 79 and 80 (tension). See column 4, lines 1-18. Each load cell also includes a bridge 90. See col. 4, lines 62-68. The load cells are configured as part of a system that includes a

plurality of the load cells. With reference to Fig. 5, the bridges 90 are coupled to a weighting preamp 92 and the output of the preamp 92 is provided to a switch 96. The Office action cites this switch 96 as constituting the recited switching device.

Dillon actually provides extremely little disclosure or teaching relating to switch 96 or its function. The description of it is found almost entirely, if not entirely, at column 4, line 62 through column 5, line 15. Significantly, substantial detail is provided later in the patent about the operation of the overall device, particularly the processing done for each of the cells, and for the cells within the system. Applicants can find nothing in this discussion, however, that refers to the switch 96 or its operation.

It appears clear, in part based upon the paucity of description concerning switch 96 and its associated functionality, that they are fundamentally different from the switching devices and functions as recited in claims 26-34. The Dillon et al. switch, for example, switches between load cells, and not between the individual strain gauges or strain gauge pairs of a given cell. Moreover, Dillon et al. does not involve switching between an axial stress measurement configuration and a bending stress measurement configuration, as recited in claim 26.

Claim 35 patentably distinguishes over Maw and Dillon, taken alone or in combination, for example, in that neither of these references discloses or suggests an instrumented pin member that comprises a pin member body disposed about a pin member axis, the pin member body comprising a bending portion, a sensing device positioned on the pin member body within the bending portion for sensing a

bending stress in the bending portion during a bending stress measurement mode and for outputting a sensor measurement signal, a switching device operatively coupled to the sensing device for switching the sensing device in and out of the bending stress measurement mode, and a sensor signal output device for communicating the sensor measurement signal, as recited in claim 35.

Maw is deficient, for example, in that it fails to disclose or suggest a sensing device for sensing a bending stress in a bending portion during a bending stress measurement mode. It also fails to disclose or suggest a switching device for switching the sensing device in and out of the bending stress measurement mode, as recited in claim 1. This is acknowledged in the Office Action, e.g., at page 7.

Dillon fails to remedy this deficiency for the reasons set forth above with regard to claims 26-34.

Claims 37-38 patentably distinguish over these documents, e.g., based on their dependence from and more specific recitation with respect to claim 36.

Conclusion

In view of the foregoing, not only claims 12-24, but also claims 1-11 and 25-43, i.e., all pending claims, patentably distinguish over the cited and applied documents. Applicants accordingly request reconsideration of the application and allowance of these claims.

A Petition and fee are being concurrently filed with this Response. It is Applicants' understanding that there are no further fees due in connection with the filing of this Response. If any fees are due in connection with the prosecution of this application, please charge the fees to our Deposit Account 501324.

Date: October 3, 2002

Respectfully submitted,

By: ______________________

Stephen T. Sullivan
Reg. No. 32,444

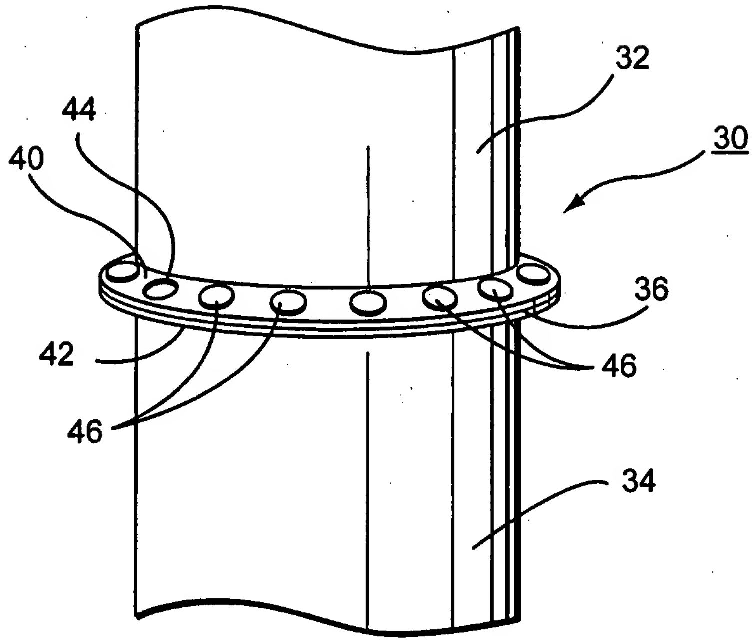
32
30
44
40
36
42
46
46
34

Fig. 1

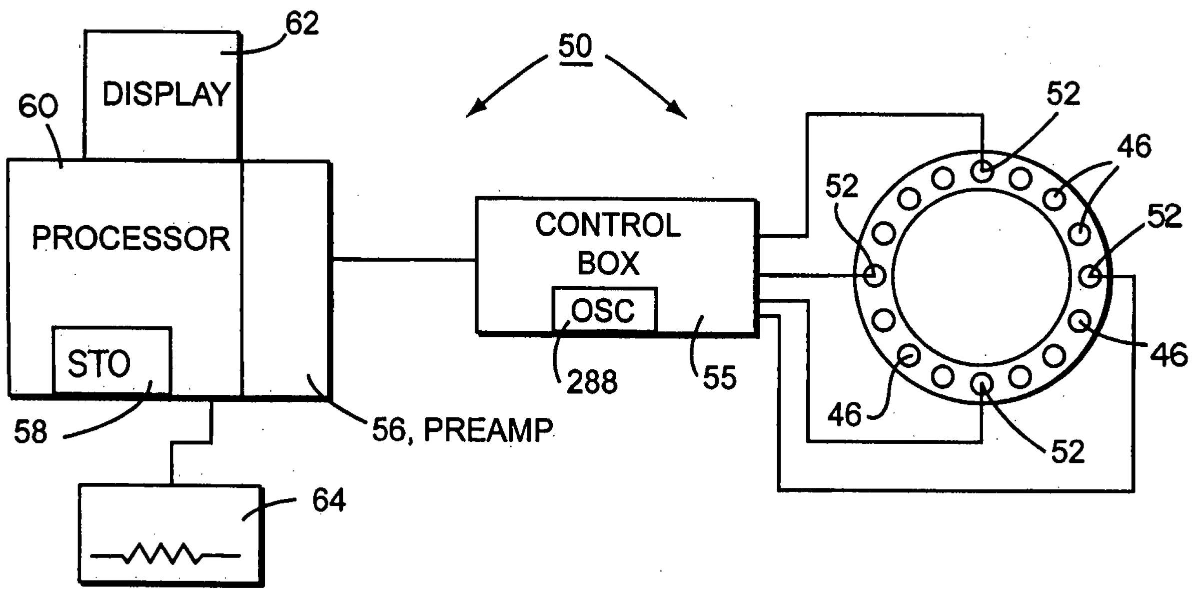
62
50
DISPLAY
60
PROCESSOR
STO
58
56, PREAMP
64
CONTROL BOX
OSC
288
55
52
46
52
52
46
46
52

Fig. 2

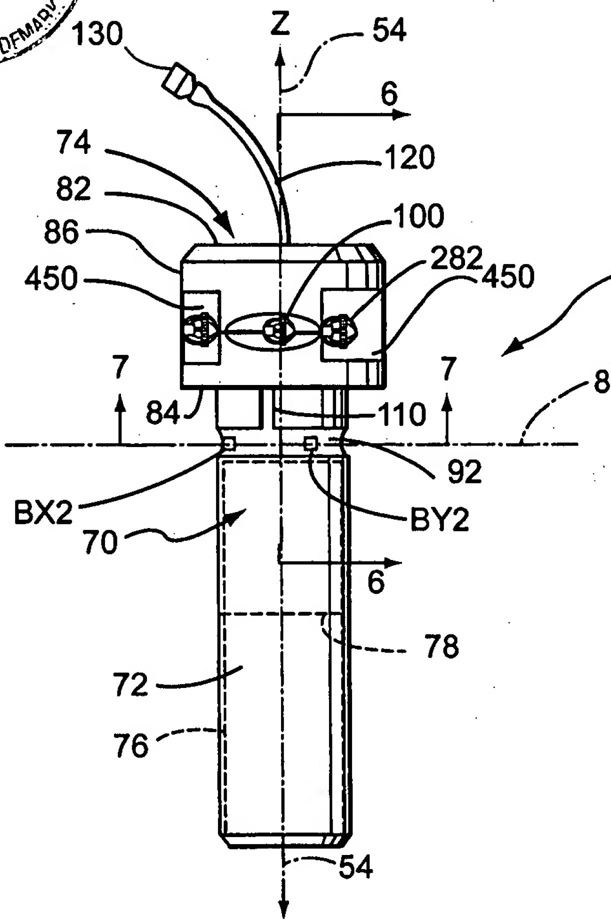

Fig. 3

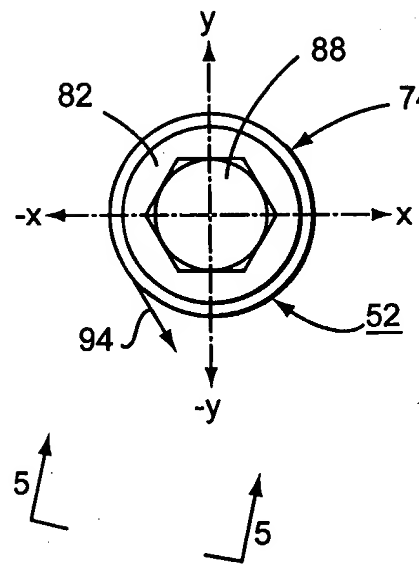

Fig. 4

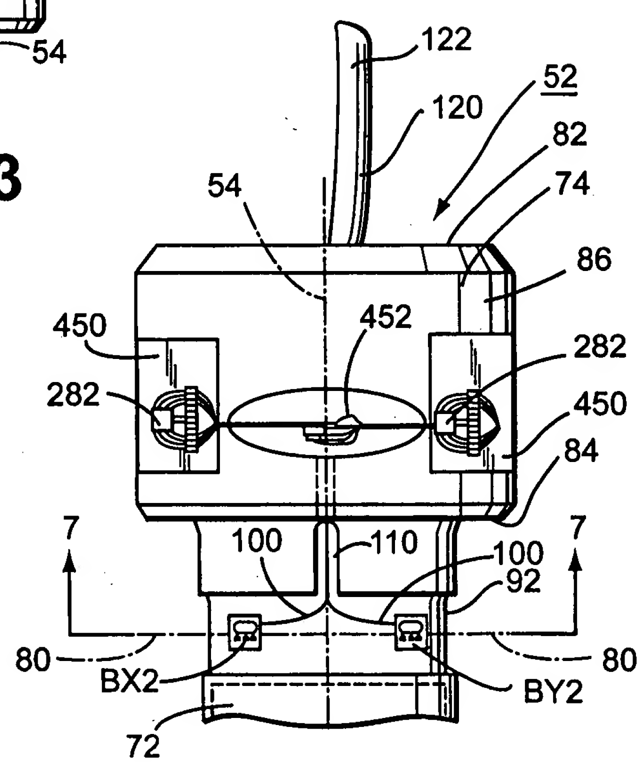

Fig. 5

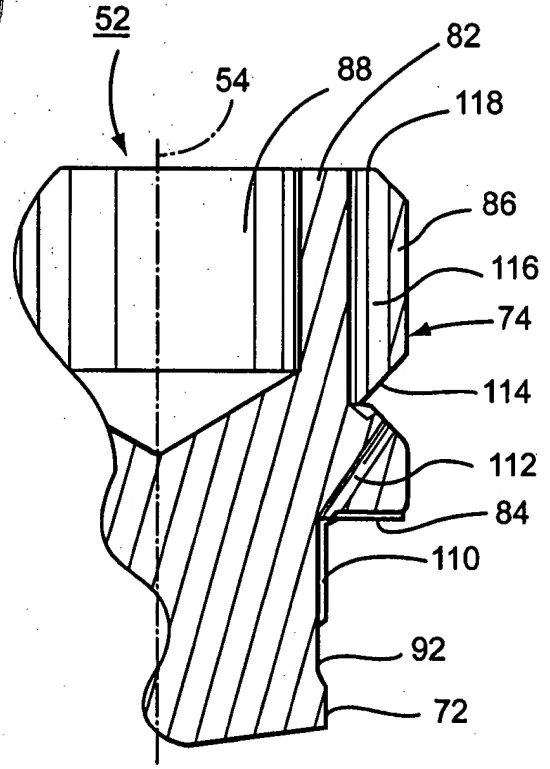
52
54
88
82
118
86
116
74
114
112
84
110
92
72

Fig. 6

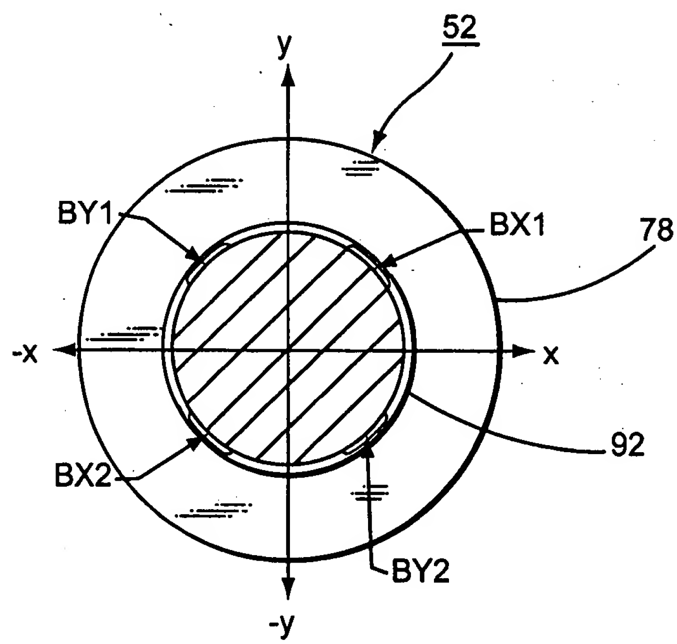
y
52
BY1
BX1
78
-x
x
92
BX2
BY2
-y

Fig. 7

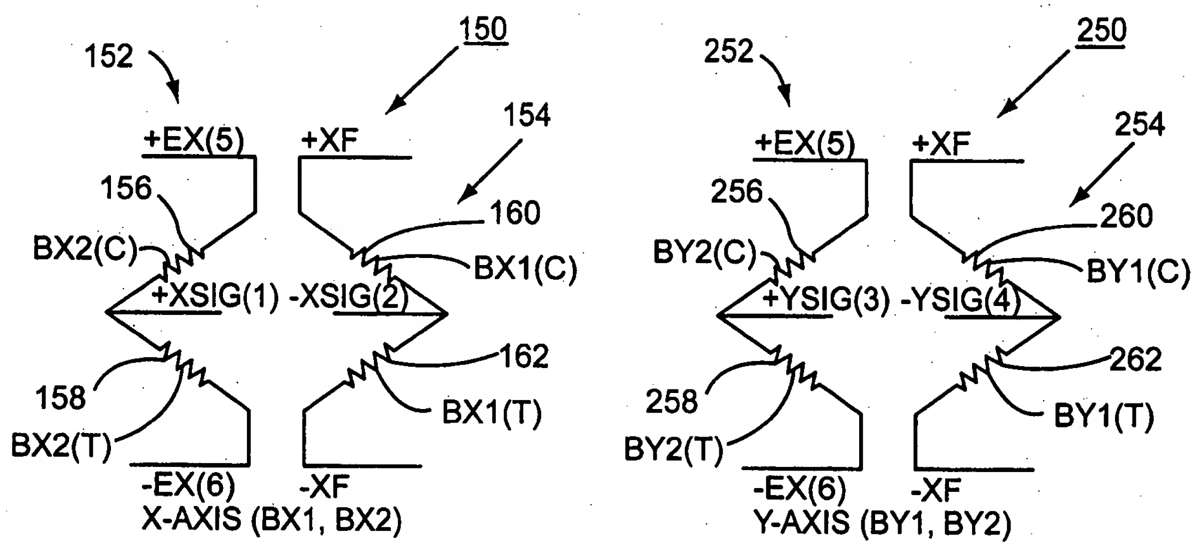
152
150
154
+EX(5)
+XF
156
160
BX2(C)
BX1(C)
+XSIG(1)
-XSIG(2)
162
158
BX1(T)
BX2(T)
-EX(6)
-XF
X-AXIS (BX1, BX2)
252
250
254
+EX(5)
+XF
256
260
BY2(C)
BY1(C)
+YSIG(3)
-YSIG(4)
262
258
BY1(T)
BY2(T)
-EX(6)
-XF
Y-AXIS (BY1, BY2)

Fig. 8

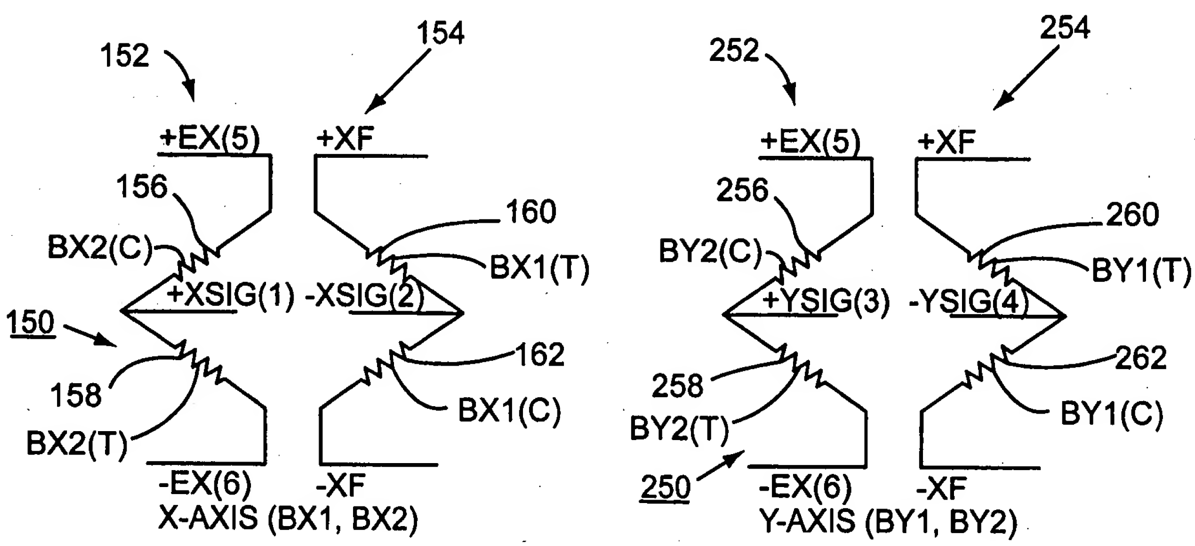
152
154
+EX(5)
+XF
156
160
BX2(C)
BX1(T)
+XSIG(1)
-XSIG(2)
150
162
158
BX1(C)
BX2(T)
-EX(6)
-XF
X-AXIS (BX1, BX2)
252
254
+EX(5)
+XF
256
260
BY2(C)
BY1(T)
+YSIG(3)
-YSIG(4)
262
258
BY2(T)
BY1(C)
250
-EX(6)
-XF
Y-AXIS (BY1, BY2)

Fig. 9

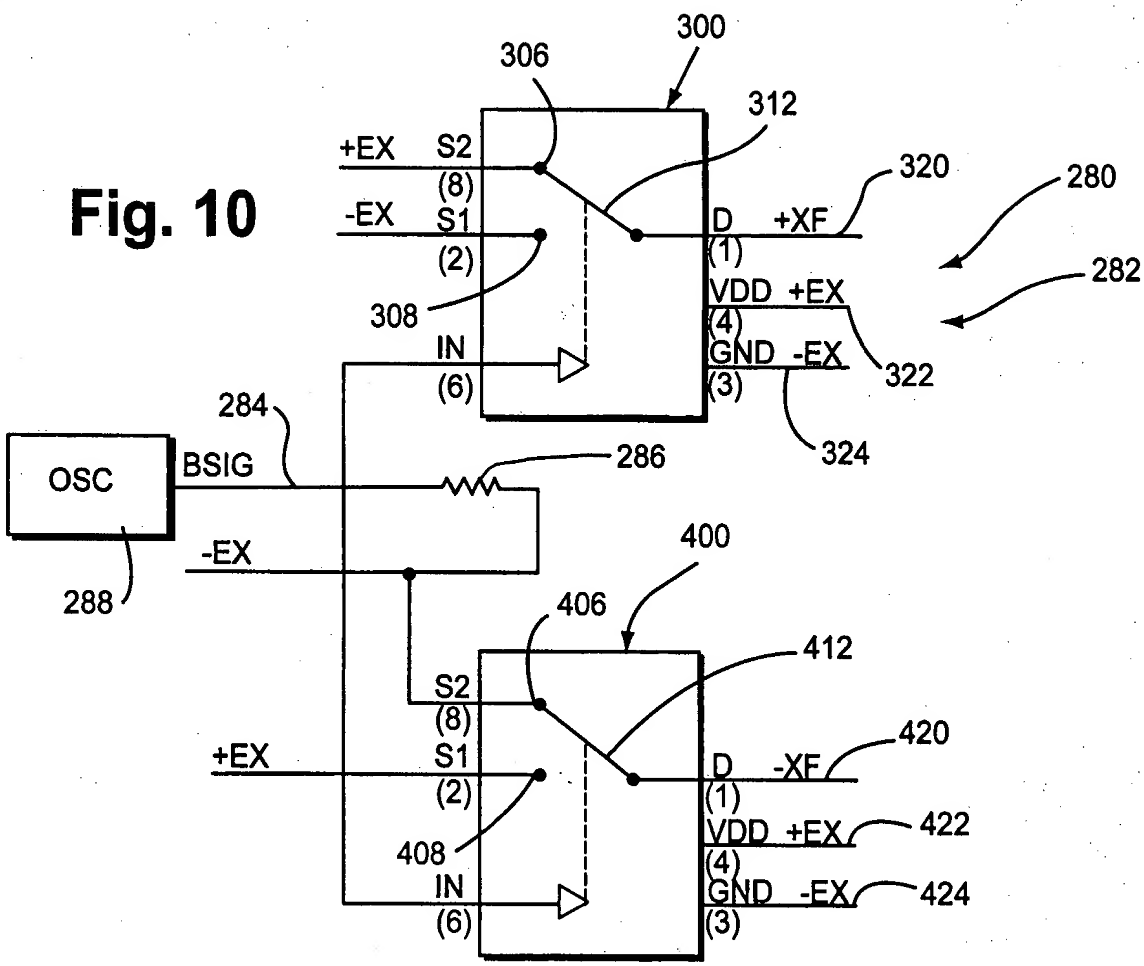
300
306
312
320
280
282
+EX
S2
(8)
-EX
S1
(2)
D
+XF
(1)
VDD +EX
(4)
GND -EX
(3)
308
IN
(6)
322
324
284
OSC
BSIG
286
-EX
288
400
406
412
S2
(8)
+EX
S1
(2)
D
-XF
(1)
420
VDD +EX
(4)
422
408
IN
(6)
GND -EX
(3)
424

Fig. 10

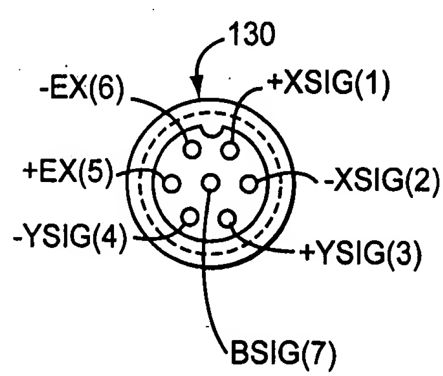
130
-EX(6)
+XSIG(1)
+EX(5)
-XSIG(2)
-YSIG(4)
+YSIG(3)
BSIG(7)

Fig. 11

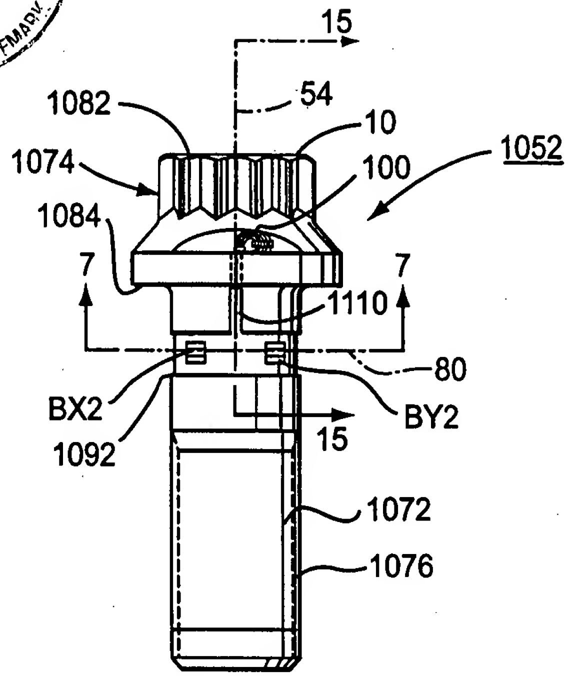

Fig. 12

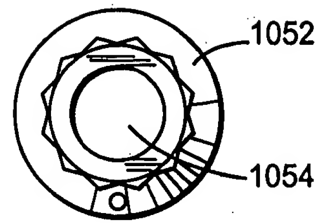

Fig. 13

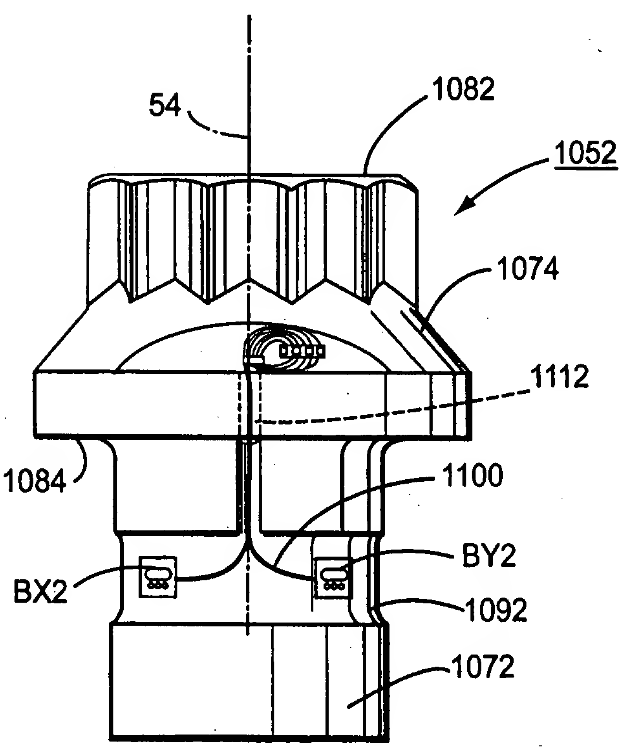

Fig. 14

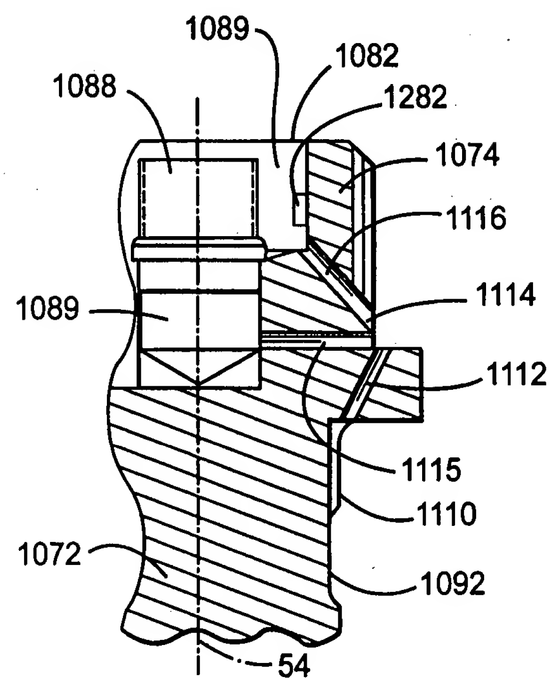

Fig. 15